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Case Report

A Sequential Approach for an Asymmetric Extraction Case in Lingual Orthodontics

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To resolve the dental asymmetries, it is important to determine the treatment midline with facial midline as a reference and the anchorage value at each quadrant. Then the correction of midline and molar key should be conducted from the initiation of treatment. Therefore, the simulation of desired tooth movement prior to treatment is an essential part of orthodontic diagnosis. Moreover, considering that many adult patients have various degree of periodontal breakdown, a strategic tooth movement in order not to cause undesired round tripping is utmost important. Recently, virtual simulation have been developed and introduced to visualize three-dimensional desirable tooth movement to achieve treatment goals. In this report, we present a sequential approach for an asymmetric extraction case involving torque control with a lever arm in lingual orthodontics.

Key words: Dental asymmetry, Sequential approach, Three-dimensional VTO

INTRODUCTION

Perfect bilateral body symmetry is largely a theoretical concept that seldom exists in living organism.[1] Especially in the area of orthodontic treatment, we encounter various degrees of asymmetric patients every day.

To resolve the dental asymmetries, it is important to determine the treatment midline with facial midline as a reference and the anchorage value at each quadrant. Then the correction of midline and molar key should be conducted from the initiation of treatment. Once the denture midline is established according to the treatment midline, the midline must be maintained throughout the treatment to provide a guideline for appropriate force systems at each quadrant.[2] Therefore, the simulation of desired tooth movement prior to treatment is an essential part of orthodontic diagnosis especially in cases exhibiting dental asymmetries. Moreover, considering that many adult patients have various degree of periodontal breakdown, a strategic tooth movement in order not to cause undesired round tripping is utmost important.

Occlusogram has been widely used to determine the anchorage requirements, arch length status, final arch widths, extractions, and the final occlusal relationships.[3] Recently, virtual simulation have been developed and introduced to visualize three-dimensional desirable tooth movement to achieve treatment goals.

In this report, we present a sequential approach for an asymmetric extraction case involving torque control in lingual orthodontics.

DIAGNOSIS

A 48-year-old female patient visited our hospital for

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treatment of lip protrusion and crowding (Fig. 1). In clinical examination, patient showed convex profile with 4 mm lip incompetency at rest. The active mouth opening was 40 mm with asymptomatic temporomandibular joint. Generalized gingival recession and moderate crowding was noted in intraoral photos. Also overall tooth wear and scissor bite on #45 was observed. The overjet was 6 mm and overbite 2.5 mm. The molar relationship was class I on right side and 3/4 class II on left side. The upper and lower dental mid-

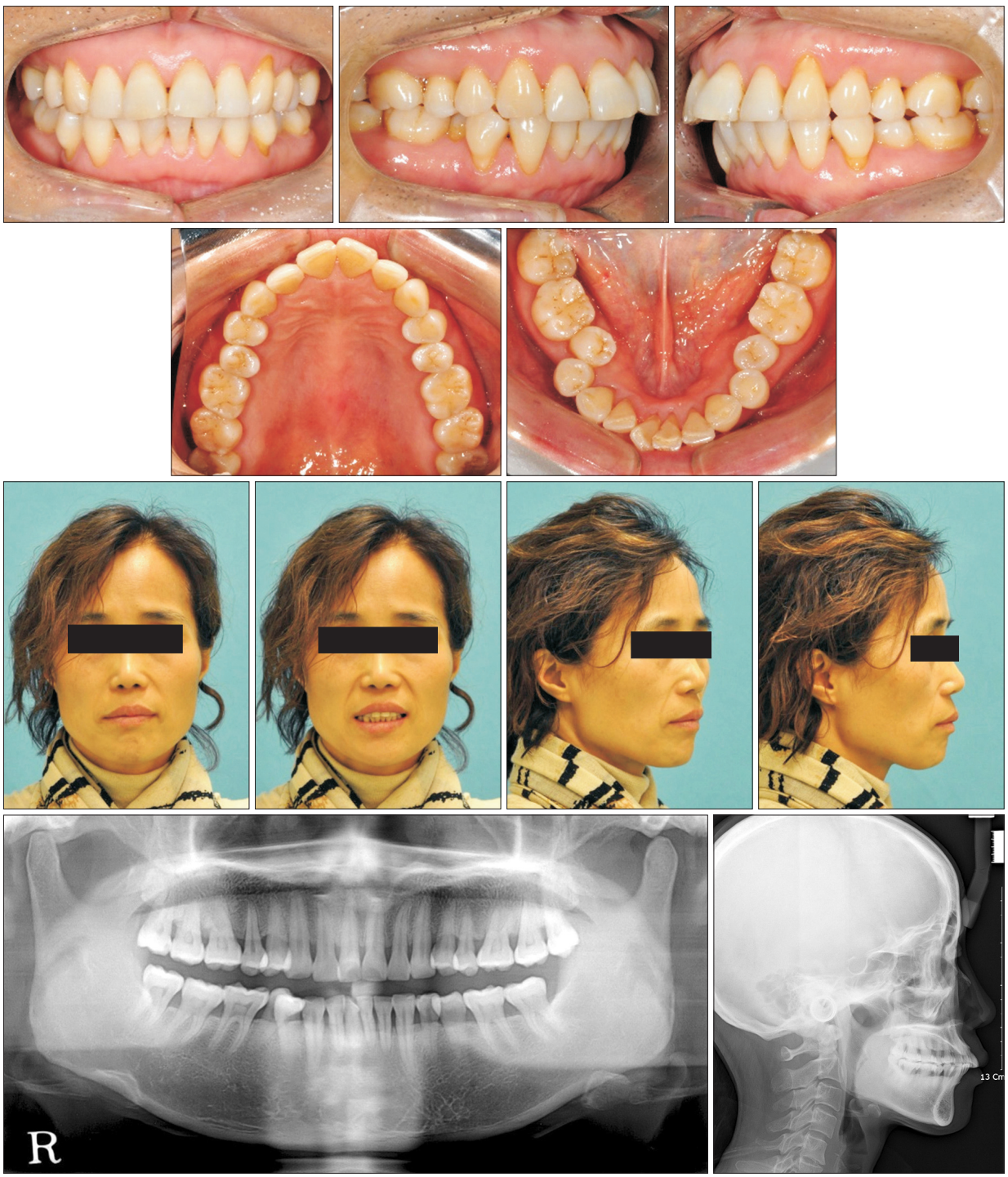

Fig. 1. Initial recording.

line coincided with facial midline. In particular, initial periapical radiographs showed moderate to severe alveolar bone loss in the mandibular anterior segment, which requires minimally invasive tooth movement in that area.

On the basis of the cephalometrics, the maxilla and mandible were within normal range for the cranial base but the upper and lower incisors showed labial inclination. Consequently, the protrusion of lips and hyperactivity of chin were observed in the lateral facial photograph. The panoramic view showed generalized alveolar bone loss, especially on mandibular anterior area, and fully erupted #18, 28, 48.

Based on the above findings, the patient was diagnosed as skeletal class I with protrusion and crowding.

TREATMENT PLAN

To improve facial profile, 7.0 mm retraction of upper incisors and 3.0 mm retraction of lower incisors were planned. According to the superimposition between the initial and simulated final virtual models, the anchorage value was estimated as type A in maxillary dentition, type B in mandibular right quadrant with extraction of #14, 24 and 44. In contrast, 3.0 mm distalization of lower left molar segment was needed for the maintenance of denture midline (Fig. 2).

TREATMENT PROGRESS

Following the extraction of 3 first premolars, bracket was bonded on upper 6 incisors for segmental alignment. A splinted segmental lever arm was delivered and two miniscrews were placed in palatal slope for maximum retraction and intrusive controlled tipping of incisors (Fig. 3).

In the mandible, segmental distalization of #36, 37 was performed from the beginning with a passively

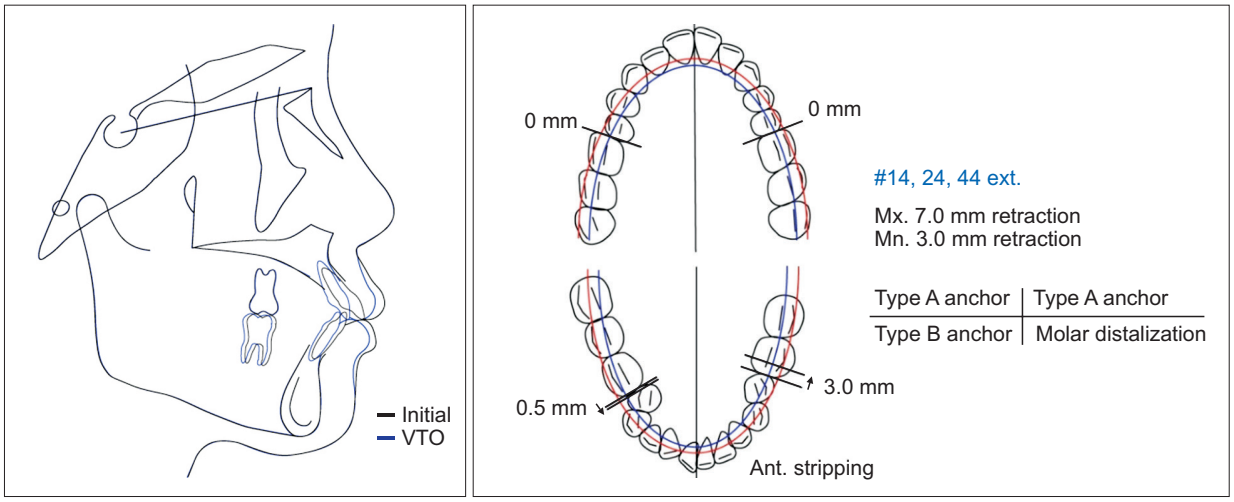

Fig. 2. Visualized three-dimensional desirable tooth movement.

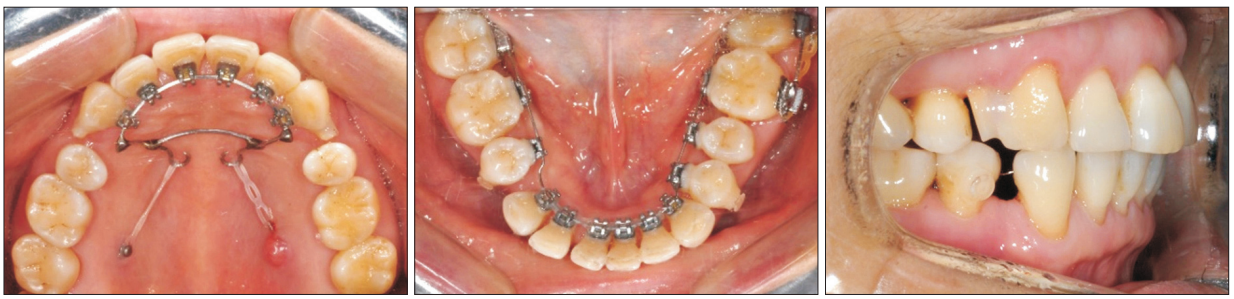

Fig. 3. Retraction with segmental lever arm and miniscrews.

Fig. 4. Recording during alignment.

Fig. 5. Modification of retraction vector.

inserted 0.016×.022 SS wire. After completion of distalization, a passive power chain was maintained to prevent mesial movement of distalized molars during anterior alignment. For the alignment of rotated mandibular incisors, coupled forces were actively used with selective bonding of 2D and Clippy-L brackets (Fig. 4).

Lateral cephalograms were taken at the beginning, mid-stage and end-stage of anterior retraction to confirm treatment progress. The retraction vector of the upper incisors was adjusted according to the tooth movement pattern (Fig. 5).

During treatment, gingivectomy was performed on the left palatal miniscrew area due to gingival inflammation.

After the extraction space was almost closed, brackets were bonded on upper molars and remaining spaces were closed on .016×.022 SS wire.

TREATMENT RESULTS

Total treatment ended in 20 months. The post treatment records show considerable improvement of facial profile (Fig. 6). The protrusion and lip incompetency were relieved by the retraction of incisors. The crowding was relieved and all roots are well aligned. The intraoral photos show proper intercuspation.

In superimposition, upper and lower incisors show intrusive controlled tipping movement almost close to translation (Fig. 7). Root resorptions of the upper and lower Incisors were observed in panoramic view. But, there was no remarkable alveolar bone resorption compared to initial recode.

DISCUSSION

Considering that the patient was in her middle ages, the treatment ended in a relatively short time (20M). This may be attributed by the simultaneous movement at each quadrant according to the initial treatment plan made based on the treatment midline.

For torque control in lingual orthodontics, the lever arm, pre-torqued wire and tandem wire technique can be used. Among them, the lever arm is available in various designs of force system and easily adjustable vector as needed during treatment.[4,5] According to previ-

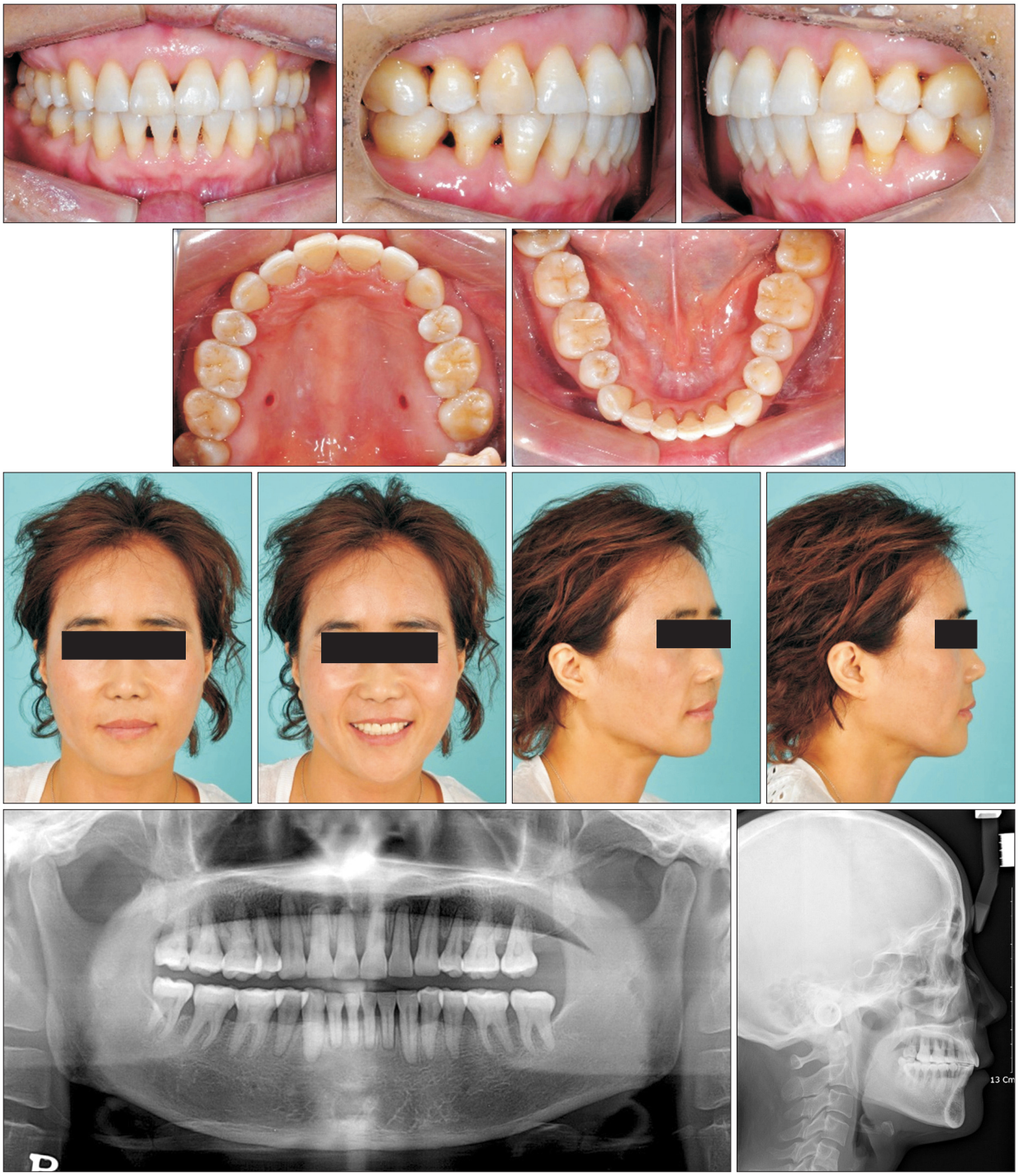

Fig. 6. Recording after debonding.

ous studies, the 20 mm lever arm is recommended for translation and a splinting of lever arms is necessary to avoid wire deformation that results in the tipping and extrusion of incisors.[6,7] And precise force control with continuous monitoring is highly emphasized because the treatment result depends almost on the determined force system,[8] which is even more for the segmented lever arm without guiding wire.[4,7]

In this case, the 20 mm splinted segmental lever arm was selected based on previous studies. Lateral cepha-

Table 1. Cephalometric assessment of before and after treatment

	Pretreatment	Posttreatment
Sagittal skeletal relations		
Maxillary position S-N-A	83.2	82.8
Mandibular position S-N-Pg	79.3	78.1
Sagittal jaw relation A-N-Pg	3.9	4.7
Vertical skeletal relations		
Maxillary inclination S-N / ANS-PNS	7.0	7.0
Mandibular inclination S-N / Go-Gn	29.7	31.8
Vertical jaw relation ANS-PNS / Go-Gn	22.7	24.8
Dento-basal relations		
Maxillary incisor inclination 1 - ANS-PNS	122.8	108.3
Mandibular incisor inclination 1 - Go-Gn	107.1	102.4
Mandibularincisor compensation 1 - A-Pg (mm)	7.3	5.8
Dental relations		
Overjet (mm)	6.0	2.5
Overbite (mm)	2.5	2.0
Interincisal angle1 / 1	105.2	123.7

lograms were taken periodically during retraction and the vector was modified. As a result, maximum retraction of incisors with proper torque control was achieved (Table 1, Fig. 7).

In the superimposition, mandibular plane angle was slightly increased despite the intrusive retraction. But, bite opening was not observed during treatment and the patient did not complain of any discomfort in occlusion. Therefore, it is thought that the occlusion and mandibular position were gradually changed throughout the entire treatment period due to repeated Botox injection based on the patient's statement.

CONCLUSIONS

For effective and accurate treatment of asymmetric extraction cases, the simulation of tooth movement and sequential approach are essential. And, proper torque control could be achieved by using the lever arm with precise force system in lingual orthodontics.

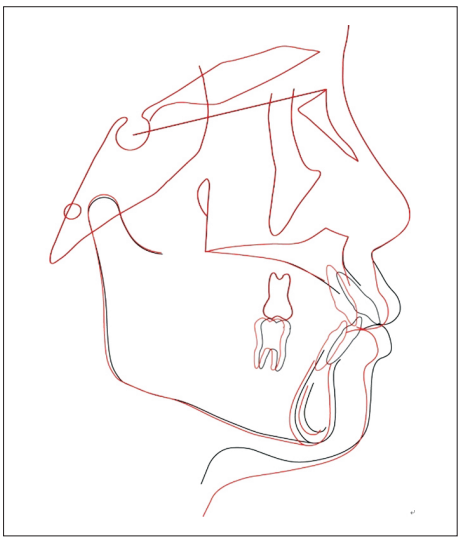

Fig. 7. Superimposition.

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